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AUTOMATED LOGISTICS
INFORMATION SYSTEMS:
A CASE STUDY

THESIS

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AUTOMATED LOGISTICS INFORMATION SYSTEMS:
A CASE STUDY

THESIS

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Information Resource Management

James E. Hogue, B.Mus.

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Preface

This was the final effort I made for the Air Force. In the past 12 years, my goal has been to make other's jobs the easiest and least stressful as possible through controlling, modifying, or eliminating the bureaucracy inherent in my work and increasing the communication and cooperation between all those I have come in contact with. My hope is that this work will continue that tradition with recommendations that, if implemented, would lead to greater communication between people and support systems.

Just as in all my endeavors, this is not the effort of one man, but a compilation of the work of many people. My thanks goes to the Greene County, Montgomery County, Wright State University, Air Force Institute of Technology, and the 2750th Air Base Wing Master Publications librarians who, on multiple occasions, spent time and effort trying to locate references that did not exist. I thank the people at the Standard Systems Center, Gunter Air Force Base, Alabama, who took the time to explain to an ignorant researcher how their systems worked and identified contact points and information gurus for the same. Without the reams of documentation, briefings, and historical documents they sent, the background for each of the systems under study would have been impossible to construct. I also thank the 2750th Logistics Squadron and the 2046th Communications Group for allowing me to witness the workings and learn some of the intricacies of the systems.

I appreciated Majors Wayne Stone and Steve Teal's balanced perspective and how they ensured the quality and timeliness of the thesis.

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Abstract

A change within the Air Force has shifted management responsibilities within the logistics community. Formerly diverse functions have come under the purview of a single manager—the Logistics Group Commander—who has inherited information systems that may not be able to provide consolidated information for informed and accurate decision making. The purpose of this thesis was to describe the current and potential ability for three logistics information management systems to share data: Standard Base Supply System, Consolidated Aircraft Management System, and On-Line Vehicle Information Management System.

A systems model was synthesized from the literature review to determine what components of a system may impact data sharing. Identified were input and output, applications without a database management system, absence of a database management system, and the data itself.

Data was gathered through the study of each system's documentation along with interviews from systems managers and experts. It was found that documentation for system data was inadequate and was the largest obstacle to data sharing.

Recommendations included revising documentation, providing more input and output capability for the On-Line Vehicle Information Management System, and redesigning the On-Line Vehicle Information Management System to operate around a database management system.

AUTOMATED LOGISTICS INFORMATION SYSTEMS:

A CASE STUDY

I. The Problem

Introduction

Rapid and pervasive changes have occurred within the United States economy and the international politico-military situation leading to a massive streamlining of the Air Force. Operational controls have been reoriented. Functional areas have been redefined, regrouped, and reorganized. Some structures have been eliminated and others have been changed so that they bear little resemblance to their previous forms. Throughout this streamlining, the basic building block of the Air Force has remained virtually intact— the operational wing. The wing has not remained unscathed, however.

Background of the Problem

Prior to 1992, the predominant structure of the Air Force Wing was the tri-deputy system. This structure consisted of a deputy commander of operations, deputy commander of maintenance, and deputy commander of resource management. Figure 1 is an organization structure chart for a standard tri-deputy wing.

In early 1992, General Merrill A. McPeak, Chief of Staff of the Air Force, identified an "objective wing" in which logistics functions were aligned under a Logistics Group Commander and most aircraft maintenance functions were aligned under flying squadron commanders (McPeak, 1992). Figure 2 is an organization structure chart of the objective wing.

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Figure 1. Typical Wing, Prior to 1992

```
OFF BASE                    WING ——— COMM
SUPERVISION
                    DO        MA        R M        CSG
                    OPS     A/C GEN    SUPPLY    MSN SUPT
                    OPS      COMP       TRANS    SEC POL
                             MAINT
                    OPS      COMP                CIVIL ENG
                             REPAIR
LOTS OF                                          SERVICES
LARGE
TENANTS
```
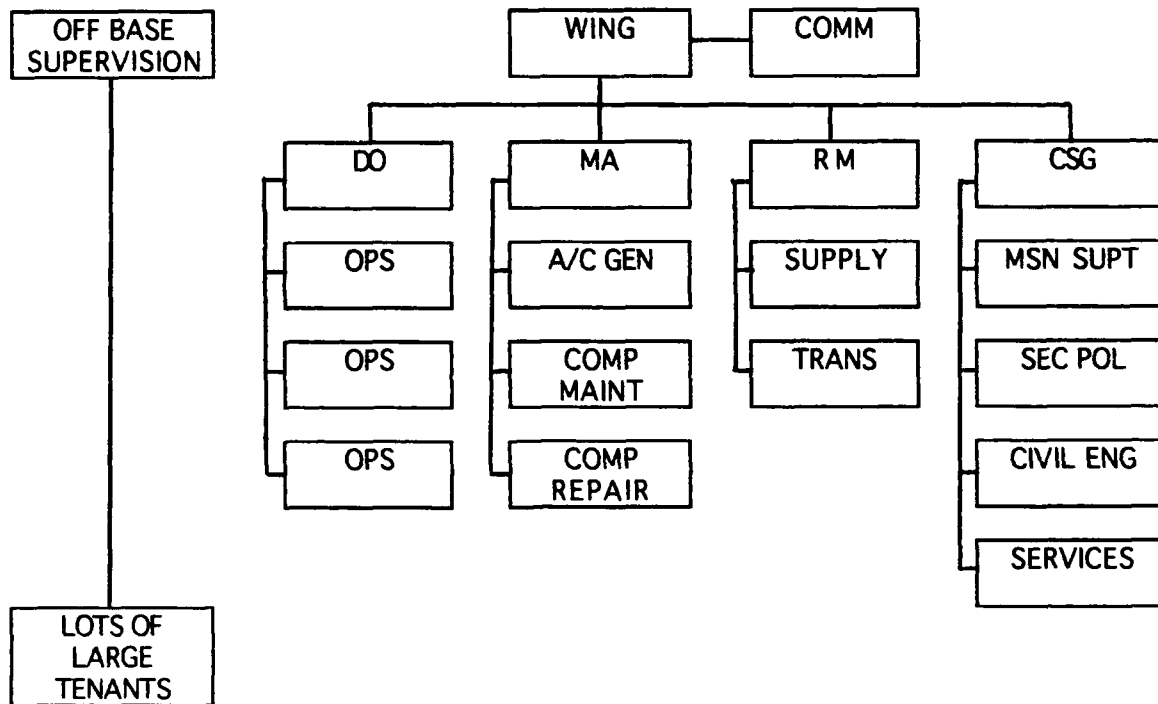
Figure 1. Typical Wing, Prior to 1992   (McPeak, 1992)

Figure 2. Objective Wing

```
OFF BASE                         WING
SUPERVISION

            OPERATIONS      LOGISTICS      SUPPORT GROUP
            GROUP           GROUP

            OPS SUPT        LOG SUPT       MSN SUPT
            OPS             SUPPLY         SEC POLICE
            OPS             MAINTENANCE    CIV ENG
            OPS             TRANS          MWR/SVS
A FEW SMALL                 CONTRACTING    COMM
TENANTS
```
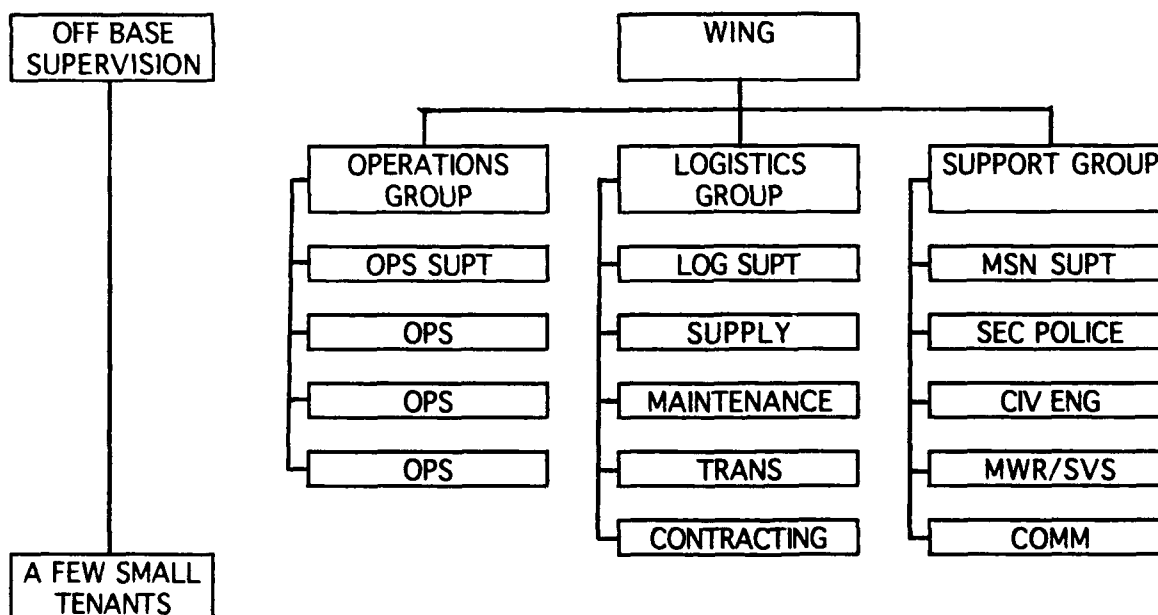
Figure 2. Objective Wing   (McPeak, 1992)

Statement of the Problem Situation

Logistics information systems were designed for the tri-deputy wing (Figure 1) with management and operations responsibility for each system residing with the appropriate functional manager. The objective wing structure brought most logistics information systems under the management control of a single manager: the Logistics Group Commander. This was a major shift from the former organization (McPeak, 1992).

The Logistics Group Commander, under the objective wing, is responsible for five diverse functions—logistics support, supply, aircraft maintenance (limited to some centralized functions), transportation, and contracting—with each function supported by its own automated information system. For the Commander to acquire the data necessary for informed decision-making, each functional area has to be tasked for the relevant information. This information then has to be consolidated for consumption.

An automated information system able to query all of the individual systems and then consolidate the data appropriately could result in more efficient and accurate decision making by the Logistics Group Commander (Davis, 1988).

The single largest obstacle to implementing such an automated information system is the limited ability to share data between current systems. Data sharing means that the individual pieces of data can be understood and used by the different systems (Date, 1990:7). For data to be shared, it must be defined identically by all systems. In essence, implementing such a design results in a single database that all systems can access (Date, 1990:44, Nguyen, 1991).

Developing such a database design is the responsibility of the Secretary of the Air Force, Under Secretary for Acquisition. This office strives to provide the Air Force with

one definition for every piece of data used in every Air Force information system. In a 28 April 1992 telephone interview, Bao T. Nguyen, Air Force Data Manager, related that developing a single definition for a data name has been difficult because the information culture of the Air Force has been built around independent information systems. Information systems have grown up along functional lines with little interaction outside their respective functions. This trend has caused identical data names to appear in different systems but with diverse definitions.

In order to standardize data definitions, eliminate duplication of effort, and integrate information systems within the Air Force, information systems must be designed from their very inception with data sharing as a primary requirement. Current operational systems may, therefore, require a complete redesign to implement data sharing.

Purpose of the Study

The purpose of this thesis was to describe the current and potential ability for three logistics information management systems to share data. Each system was studied to find commonalties that would indicate that data sharing had or could occur.

Description of the Study

Systems for this study were chosen from three functional areas under the control of the Logistics Group Commander. In order to analyze each system, specific portions were studied in detail. The purpose, requirements definition, structure, operating environment, data, input, output, and interface abilities were studied to determine similarities and differences between the systems. The study was descriptive in nature using a case study approach.

Importance of the Study

This study performed two functions. First, the study served as a historical perspective on logistics information systems within a changing Air Force.

Second, this study may serve as a basis for further research in designing a fully integrated information system within the logistics community. Additional investigations broadening the scope of the current study would serve to expand knowledge of current system interactions and potentially result in a stronger basis for replacement systems.

Scope of the Study

Due to the diversity of logistics information systems, it was not possible to compare all available systems. The systems chosen for this study were implemented Air Force-wide and represented functional areas under the Logistics Group Commander. Systems represent supply, transportation, and aircraft maintenance functional areas.

Definition of Terms

Application. 1. The task to be accomplished by a computer system; for instance: word processing, accounts payable, and statistical analysis (Hipgrave, 1985; Pfaffenberger, 1991). 2. The integration of logically related programs to accomplish a specific purpose (Ahituv and Neumann, 1990; Senn, 1989). Applications have been used as a user interface or "front end" to database management systems (Date, 1990).

Artificial Intelligence. A computer science field that attempts to improve computers by endowing them with some of the characteristics associated with human intelligence, such as the capability to understand natural language and to reason under conditions of uncertainty (Pfaffenberger, 1991).

Data. A general term used to denote the raw facts and figures that are used for discussion, decision-making, calculating, or measuring (Hipgrave, 1985; McLeod, 1986). Data is in the form of letters, numbers, and symbols and can be contained inside or outside of an automated system. For the purpose of this paper, data will be considered to be stored within an automated system or on magnetic medium.

Data Dictionary. This term is alternately referred to as a data directory or meta-data (Hipgrave, 1985; Date, 1990; Pfaffenberger, 1991). Within a database management system, the data dictionary contains the explanation of the format of the data within the database. It also includes definitions of other objects in the database, the structure of the database, and how different users view the data. A comprehensive data dictionary may include cross references on what data is used in which applications, which users require which reports, and what terminals are connected to the system.

Data Element. A single unit of data within a database (Hipgrave, 1985; Date, 1990). For instance, DATE would be a data element within most databases.

Data Sharing. Multiple applications, users, and processes have access to individual pieces of data and can use that identical piece of data for different purposes. Simultaneous (concurrent) access is also implied (Date, 1990).

Database. A computerized collection of related information about a subject organized in a useful manner that provides a base or foundation for procedures such as retrieving information, drawing conclusions, and making decisions (Date, 1990; Pfaffenberger, 1991). This data repository is accessed by using the computer's software (Hipgrave, 1985; Date, 1990).

Database Management System (DBMS). A software package that facilitates the creation and manipulation of a database (Date, 1990; Hipgrave, 1985; McLeod, 1986). Some of the functions the DBMS performs include defining, processing, retrieving, adding, changing, or deleting data within a database (Date, 1990; Kroenke, 1992; Pfaffenberger, 1991).

Flat File Database. A database that stores, organizes, and retrieves information from only one file at a time (Pfaffenberger, 1991).

Hardware. The physical components of the computer. It includes input devices, output devices, one or more processing units, memory, and storage devices. The hardware is incapable of manipulating data by itself. With instructions from a program, the hardware is able to move and process data (Hipgrave, 1985; Savitch, 1988; Sullivan, Lewis, and Cook, 1985).

Logistics Information System. Management information systems that are specifically designed for the logistics environment.

Management Information System (MIS). An information system that provides managers at all levels of an organization with the information needed for making deci-sions by exploiting the data held within the database (Hipgrave, 1985; Ahituv and Neumann, 1992).

On-Line Processing. Processing mode where transactions are entered immediately into the database system (McLeod, 1986).

Operating system. The software that is used as an interface between the user, the applications, the database management system, and the physical hardware of a computer. The operating system supervises the workload of the computer, controls input and

output, manages the computer's memory, places data on storage media, protects the user from errors within the computer or application, provides a way to share data between programs, and controls the sequence of execution for programs (Hipgrave, 1985; Lister, 1984).

Schema. A complete logical view of the database (Kroenke, 1992).

Software. 1. A general term for a computer program, collection of programs, operations, or routines used to carry out tasks on a computer. 2. Anything that is not hardware, including documentation (Hipgrave, 1985).

Transaction. 1. An event that requires or generates data. 2. A change of data within a database. 3. A complete processing operation (Hipgrave, 1985).

Transmission Control Procedure/Internet Protocol (TCP/IP). A file transfer protocol for use in electronically connected computers. TCP/IP was developed by the U.S. Department of Defense (Stamper, 1991).

Outline of the Remainder of the Thesis

Chapter I introduced the thesis problem and detailed why it is important to study the potential for interaction between current logistics information systems. It concluded with definitions of terms used throughout the thesis. Chapter II reviews the literature on data sharing and introduces the three logistics information systems. Chapter III describes the case study method and the particular methodology of this thesis. Chapter IV provides a comparative analysis of each system. Finally, Chapter V summarizes the previous four chapters, draws conclusions about the interaction of the three logistics information systems under study, provides recommendations for enhancing data sharing, and identifies further opportunities for research.

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II. Review of Related Literature

Organization of the Present Chapter—Overview

This chapter begins with a history of shared data technology, theories of data sharing, and concludes with an introduction to the three logistics information systems being studied.

History of Data Sharing Technology

Computers were first used for business applications in the 1950s. Slow, cumbersome, and highly inefficient programs were written in machine language, a code composed entirely of 0s and 1s. Input and output was in the form of punched cards. Data groups in these computers were in the form of fields, typically expressed in bits, bytes, and words. With the low level of these constructs and the relative scarcity of computers, there was no need for data sharing. Programmers produced unique programs for unique machines that performed unique operations on unique data. (Jones, 1992; Sullivan, Lewis and Cook, 1985)

Not until the 1960s with the advent of the transistor and high-level programming languages, were computers considered economically viable for general business purposes. With the introduction of the COmmon Business Oriented Language (COBOL), programmers were able to describe data in more general terms. COBOL provided the concept of fields linked together to form records, and records linked together to form files. Two major limitations plagued the early systems, however. First, records could only be accessed within files in two ways: sequentially or directly. Sequential access means that to locate an individual record, every record in a file had to be read, starting at the beginning of the file, until the record needed was found. Direct access means that the exact location of the record within the file had to be known to

access it. Accessing data was a problem because the location of the specific record was contained only within the application. Data used within one application was worthless to another because of inconsistencies in the way each application stored data. Access limitations were overcome in the late 1960s with the introduction of access methods within software utilities called file management systems. "These systems developed and standardized models for organizing files and methods for accessing records within files" (Jones, 1992: 58). Data storage methods were no longer application specific.

The second limitation with early systems was that files were formatted and owned in a proprietary fashion by the using application. Data, records, or files from one application could not be shared with other applications. This limitation was not overcome until 1971 when the Committee On DAta SYstems Languages (CODASYL) standardized the network data model as the database organization structure. The network model allowed a host language (such as COBOL) to manipulate data through a "call" sequence that insulated the programmer from the data, allowing multiple applications to access the same data (Date, 1990). The network data model provided a good foundation for data sharing, but was not understood by users. "The users could not effectively communicate their requirements, understand the constraints imposed on them by these systems, or control their own data management destiny" (Jones, 1992: 58).

In 1970 and 1971, E. F. Codd defined a mathematically based data organization approach that was specifically designed to provide for the integration of databases and the development of integrated database systems. The data was stored in tables with no physical linkage between the tables. Data manipulation was provided through a language that, like the network model, could be called from a host language. The language could also be used independently to provide ad hoc inquiries in near English. This "relational" database enabled users and developers to overcome the shortcomings of the network

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model. It was not until the 1980s that developers of the relational database management systems (RDBMS) began to standardize their data manipulation language. Systems Query Language was standardized by the American National Standards Institute and the International Organization for Standardization allowing for an almost universal acceptance of the language (Jones, 1992; Date, 1990).

<u>Theories of Data Sharing</u>

Data, in complex organizations, usually reside in many different forms and in many locations. Problems become apparent when trying to access, validate, and share the data. Older systems may be in application-unique formats while newer systems may store data within a standardized format. Even though standards exist in modern systems, there is enough leniency within the standards so that products from different suppliers do not always work with the data stored by a competitor's product. Some database management systems are not flexible enough to cross the boundaries between microcomputers, minicomputers, and mainframe computers. In order to overcome data obstacles, the user needs to access all of the data regardless of where or in what form it resides (Brown, 1991; Jones, 1992; Rasmus, 1991). Differences arise, though, in exactly how data sharing should be accomplished.

This survey of recent literature revealed that there are at least two poles of thought on sharing data. All of the literature acknowledged that fully shared data, in any form, was not available at the time of this writing.

The majority of the literature reflected the opinion that the best way to assure data sharing was to design systems with sharing in mind (Goodhue and others, 1992; Jones, 1992; Staples and Sharon, 1992; Von Halle, 1992, Wolf and others, 1989). One advocated the use of a centralized data repository that would provide users with identical

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access to all data regardless of where the data may be physically stored or the type of data management system used (Jones, 1992). Another advocated designing all systems around a common information systems data model to facilitate the sharing of data (Von Halle, 1992). Not all reports were optimistic concerning the implementation of shared data, however. Although planning and implementing data-integrated systems appeared to be the answer for sharing problems, in reality, few organizations have succeeded. The primary reason for failure was that firms were not prepared to undertake the cost of rewriting all systems necessary to support the complete sharing of data (Goodhue and others, 1992).

A contrasting opinion was that re-engineering all systems was not necessary to provide access to all data. An open system interface that allowed all users to access data residing in any machine or management system would provide the same function as making the environment homogeneous. The basic premise was that an artificial intelligence module would be used to identify the requestor and where the information resided. The module would interpret the request and compile information from a variety of databases on several hardware platforms. It would then return the results in a format useable by the requestor (Rasmus, 1991).

There was a wide range of opinion as to who or what was to blame for the inability of data to be shared. Parallel development of software systems without coordination or sharing of technologies was one reason identified for the difficulty in establishing interfaces between systems or in developing an integrated approach to the entire system design problem (Davis, D., 1987). The data owners' refusal to share was mentioned as an additional contributing factor (Van Halle, 1992). The inability for current standards to deal with in-place systems might have also been an element of the problem (Jones, 1992). Another reason offered was that the standards were available,

but were not enforced (Brown, 1991). All agreed that a concerted, coordinated effort was necessary to produce an integrated data environment.

Conclusions

In spite of the wide variety of perceived causes for the lack of data sharing, only two solutions were suggested in literature. The majority of the contributors advocated redesigning all applications around a common framework to solve the sharing problem. An alternative suggested by one source was to develop an open-system interface with the capability to act as a translator between dissimilar systems.

Introduction to Logistics Information Systems

Standard Base Supply System (SBSS). In 1963, the Air Force formed the Supply Systems Design Office to "develop and control a standard USAF base supply electronic data processing system" (Special Order G-58, 21 June 1963). One of the first automation efforts in the Air Force, the SBSS functioned as a stand-alone system. Interaction with other systems was through punched-card transactions. Transactions from the SBSS for supply issues (office supplies, equipment issues, fuel, and so on) were output on card decks which were then carried to the punched-card reader of other systems for processing. Verification was through manual comparison of printed output from both systems (Tyson, 1992).

By 1983, modifications to the SBSS allowed data to be transferred electronically to the accounting and finance system. Updates from the SBSS were consolidated and processed once a week with automated verification. Later SBSS revisions allowed for more frequent updates, but still only in consolidated groups and not immediately. With Increment II of the consolidated aircraft management system (CAMS), a maintenance-supply interface was formed which allowed parts ordering and status updates to be

performed through the CAMS in individual transactions without lengthy delays (Tyson, 1992; FD-G83-004 Basic, 1983).

Consolidated Aircraft Management System (CAMS). The newest of the systems studied, CAMS was initiated 5 May 1983 when HQ USAF Data Project Directive DPD-HAF-G83-004 was issued. CAMS was to replace the Maintenance Management Information and Control System used to gather maintenance data, man-hour usage, and to track personnel training and certification (Hill, 1992). Implemented in seven increments, CAMS was to have all the capabilities of its immediate predecessor as well as (1) on-line maintenance data collection and work order generation, (2) a maintenance-supply interface, (3) automated debriefing and Air Force Technical Order Form 781-series forms generation, (4) administrative/logistics and personnel availability tracking, (5) automated scheduling and multiple status inventory reporting system, (6) follow-on comprehensive engine management system, and (7) quality control/assurance and production scheduling (FD-G83-004 Basic, 1983).

On-Line Vehicle Interactive Management System (OLVIMS). From 1971, vehicle maintenance control relied upon the Vehicle Integrated Management System (VIMS), a mainframe, punched-card system, for data management. In the late 1970s, the Air Force started a project to upgrade VIMS to run on the replacement to the Burroughs base computer, the Sperry 1100. This system would allow operators to update records and produce reports immediately from terminals rather than having to produce punched cards and wait days for printed reports. However, the project was canceled in 1985 due to a funds shortage (Fry, 1992).

In late 1985, the Standard Systems Center began work to move VIMS from the mainframe system to the USAF standard microcomputer—the Zenith Z-248. Working in

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stages, the plan was to initially provide Zenith Z-248s to act as terminals for input to the VIMS running on the mainframe and then move the processing from the mainframe entirely to the Z-248s. This first Air Force effort to transfer a major system from a mainframe to microcomputers gave birth to the On-Line Vehicle Interactive Management System (OLVIMS).

In 1986, OLVIMS Increment I fielded two million dollars worth of microcomputers as data entry terminals and gave units a key-punch replacement program with data review and edit capabilities. This effort released the maintenance control specialists from working only from printed listings and punched cards.

In 1988, Increment II of the OLVIMS changed the hardware platform from the standard base computer to the Air Force standard microcomputer. This change eliminated the vehicle maintenance facilities' dependence on the central data processing center while still maintaining all the functionality and processes of the VIMS. The VIMS was decommissioned in December 1988, after OLVIMS was fully fielded.

OLVIMS III, fielded in May 1990, provided additional improvements. It automated work order generation, work load control, warranty management, and scheduled maintenance processing. This increment was reported as saving over two million dollars by eliminating excess forms and reports, increasing productivity, and enforcing warranties. Updates to OLVIMS III have added graphic analysis reporting, parts failure analysis, and reporting aids for contracted operations.

Summary of the Literature Review

This chapter provided a history of the development of shared data technology and progressed with theories of systems sharing and concluded with introductions to the three logistics information systems under study. Chapter III describes the case study method and the particular methodology of this thesis. Chapter IV provides a comparative analysis of each system. Finally, Chapter V summarizes the previous four chapters, draws conclusions about the interaction of the three logistics information systems under study, and identifies further opportunities for research.

III. Methodology

Organization of the Present Chapter—Overview

Chapter III describes the case study method and explains why this method was chosen for use in this study. This chapter also describes some of the limitations of the case study method. This chapter concludes with a description of the data collection methods and how the data was chosen.

The Case Study

A case study "examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used" (Benbasat and others, 1987: 370). The purpose for the case study method is to "see new theoretical relationships and question old ones" (Dyer and Wilkins, 1991:614). The case study has established its usefulness in instruction and learning environments. It is effectively used in industry to analyze in-house situations and to direct problem solving because of its emphasis on detail (Böcker, 1987:64; Emory and Cooper, 1991:143; Kellogg, 1985:60).

Why the Case Study

Selecting the case study method over other research methods was based on three conditions: "(1) the type of research question posed, (2) the extent of control an investigator has over actual behavioral events, and (3) the degree of focus on contemporary as opposed to historical events" (Yin, 1989:16). Using this framework, each condition is discussed below in relation to its applicability to this thesis.

Type of Research Question. As described in Chapter I, the purpose of this thesis was to describe the current and potential ability for three logistics information management systems to share data. Each system was studied to find communalities that would indicate that data sharing had or could occur. A restatement of the purpose in the form of a research question would be: How could the three information systems share data? The strategies applicable in answering a "how" question, as identified in Table 1, are experiment, history, and case study as opposed to survey and archival analysis methods which delve into "how many" and "how much". The second criteria for determining a research method is the amount of control the researcher has over the subjects.

TABLE 1
Relevant Situations
for Different Research Strategies

Strategy	Form of Research Question	Requires Control over Behavioral events?	Focuses on Contemporary Events?
Experiment	how, why	yes	yes
Survey	who, what,* where, how many, how much	no	yes
Archival analysis (e.g., economic study)	who, what,* where, how many, how much	no	yes/no
History	how, why	no	no
Case Study	how, why	no	yes

* "What" questions, when asked as part of an exploratory study, pertain to all five strategies.

(Yin, 1989:17)

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Extent of Control. The subjects of this study are information systems that are managed centrally through the Air Force Standard Systems Center. The "subjects" are located at most Air Force installations and are dynamically changing through system maintenance and modification procedures. In essence, no control over behavioral events was available for the purposes of this research. Looking again at Table 1, Experiment is eliminated from the strategies available because this method requires control over behavioral events.

Focus. Although a limited historical perspective was given for each logistics information system, the major emphasis of the study was on the current systems. This final criteria eliminates all strategies except Case Study.

Limitations of the Case Study Method

The case study method has several inherent limitations. First, the case study method is descriptive rather than causal. The case study can only describe what events have occurred without making any inferences as to why the events occurred. Without the benefit of control over the subjects or variables, there is no predictive ability within the case study method. No assumptions can be made that identical circumstances would produce similar situations. The corollary to this observation is that the study can not be replicated to verify the results as can be done with experimental methods.

Second, the case study is designed for depth rather than breadth. Generalizations are not possible since no attempt is made to adequately describe characteristics of a population by taking observations from a sample of items. Case studies emphasize analysis of a limited number of events and their interrelations within a specific context.

Third, although the case study often uses hypotheses, the reliance on qualitative rather than quantitative data makes their support or rejection more difficult. The case study method's emphasis on detail can provide insight for problem solving, evaluation, and strategy, however.

Finally, as with all research methods, the case study relies on the investigative prowess of the researcher, even more so than with statistical and experimental methods since the case study can not be replicated. (Benbasat, 1987; Emory and Cooper, 1991).

Data Collection

The primary data collection method was through documentation research. Various forms of documentation including Air Force regulations, functional descriptions, and training materials were reviewed along with briefings and other presentations on the individual systems. Semi-structured interviews were also used to supplement the documentation. Open-ended questions solicited information on background, application output, and perceptions of usability.

Data Evaluation

A model was needed to identify components of information systems in order to determine what portions might influence data sharing between systems. The first model discovered was a general systems model   (Ahituv and Neumann, 1990; McLeod, 1986). Figure 3 shows a representation of the model used.

```
┌─────────────┐        ┌─────────────┐        ┌─────────────┐
│    Input    │────────│  Processes  │────────│   Output    │
└─────────────┘        └─────────────┘        └─────────────┘
```

Figure 3. General Information System Model   (Ahituv and Neumann, 1990;
                                                      McLeod, 1986)

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This model did not provide sufficient detail, however. Senn suggests that processes could be expanded to include applications, database management systems, and operating systems (Senn, 1989).

```
┌──────────────┐       ┌────────────────────────┐       ┌──────────────┐
│              │       │       Applications      │       │              │
│              │       ├────────────────────────┤       │              │
│    Input     │───────│ Database Management     │───────│    Output    │
│              │       │        Systems          │       │              │
│              │       ├────────────────────────┤       │              │
│              │       │       Operating         │       │              │
│              │       │        Systems          │       │              │
└──────────────┘       └────────────────────────┘       └──────────────┘
```

Figure 4. Expanded Information System Model   (Ahituv and Neumann, 1990;
                                                     McLeod, 1986; Senn, 1989)

Applications, database management systems, and operating systems are written in programming languages. Each may be in one or more languages; therefore, the various languages could be considered a component of the information system (Sullivan, Lewis and Cook, 1985).

The final component of the information system is the physical portion. The computer machinery itself, the internal and external accessories, and anything attached to the machinery, such as communication lines, constitute the physical component. The physical component is usually called hardware (Ahituv and Neumann, 1990; Stamper, 1991; Sullivan, Lewis and Cook, 1985). Figure 5 illustrates the complete information system model. Notice that all other components except language are included within Hardware since each depends, to a greater or lesser extent, on the physical components for their usefulness. Language includes the software portion of the system.

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```
┌─────────────────────────────────────────────────────────────────┐
│                         ┌─────────────────────┐                    │
│                         │      Language        │                    │
│                         │   ┌─────────────┐    │                    │
│  ┌──────────┐           │   │ Applications │    │    ┌──────────┐   │
│  │  Input   │───────────│   ├─────────────┤    │────│  Output  │   │
│  └──────────┘           │   │  Database    │    │    └──────────┘   │
│                         │   │ Management   │    │                    │
│                         │   │  System      │    │                    │
│  ┌──────────┐           │   ├─────────────┤    │    ┌──────────┐   │
│  │   Data   │───────────│   │ Operating    │    │    │ Hardware │   │
│  └──────────┘           │   │  System      │    │    └──────────┘   │
│                         │   └─────────────┘    │                    │
│                         └─────────────────────┘                    │
└─────────────────────────────────────────────────────────────────┘
```
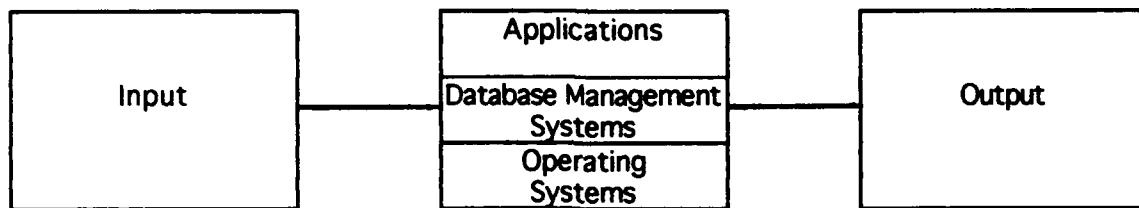
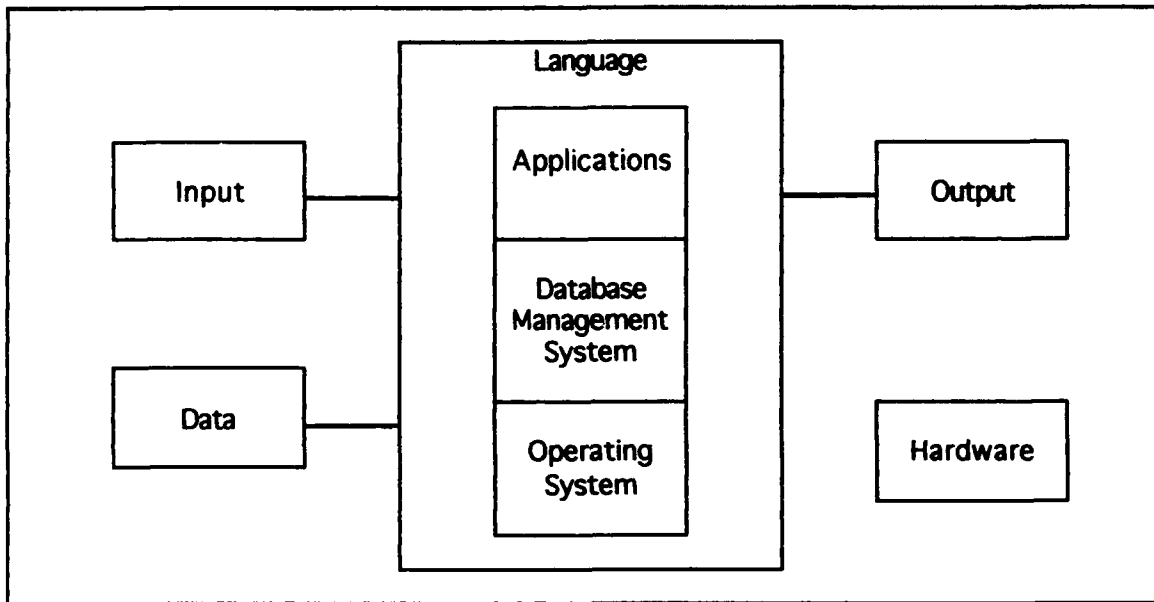Figure 5. Complete Information System Model   (Ahituv and Neumann, 1990;
                                                      McLeod, 1986; Senn, 1989;
                                                      Sullivan, Lewis and Cook,
                                                      1985)

Each of the eight system components, (1) input, (2) output, (3) applications,

(4) database management system, (5) operating system, (6) language, (7) hardware,

and (8) data, were scrutinized to see if any could impact data sharing. Below is a

narrative description of each of the components along with a discussion of whether the

component should or should not be included in the evaluation of the three logistics

support systems. Determination of inclusion or exclusion was made with the assistance

of thesis advisors.

Input and Output. Input and output were treated as one component because inputs

to one system may be outputs from another system and similar or identical methods are

used for both operations. An input uses a mechanical, electrical or magnetic medium to

place data within the system in a form that the system can understand. Common input

methods include reading magnetic tapes, magnetic disks, and punched cards; typing on

terminal keyboards; and using optical scanners and communications ports. Output

divulges the contents of the system in either a human or machine readable format. Examples of output methods included writing magnetic tapes, disks, and punched cards; and sending data to terminal screens, printers, and communications ports.

Without the ability to physically transfer the data from one system to another on a common medium, data sharing will be extremely difficult. The exact medium of transfer—electronic or mechanical—may also have some significance depending on the time and effort required to enact a data transfer. For example, keying data into a terminal from a printed output may cost more in time than the value of the data. Sharing data, although possible, may be so time consuming and labor intensive that it would not be feasible except on an infrequent basis.

Conclusion: input and output devices could impact data sharing.

Applications. An application is what the vast majority of information systems users see and interact with. The application is an integration of logically related programs to accomplish a specific purpose (Ahituv and Neumann, 1990; Senn, 1989). Applications are used as a user interface or front end to database management systems (Date, 1990). Figure 6 shows the relationships between applications, database management systems, operating systems, and hardware.
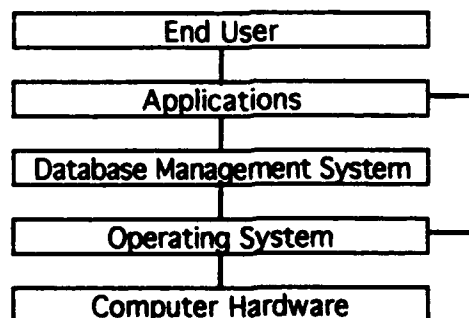

Figure 6. System Internal Relationships   (Date, 1990; Kroenke, 1992)

Conclusion: based on this design, applications used in conjunction with a database management system would not significantly impact data sharing. Applications that directly stored, retrieved, and processed data without an intervening database could have a significant impact on data sharing.

Database Management System. A database management system (DBMS) is a software package that facilitates the creation and manipulation of a database (Date, 1990; Hipgrave, 1985; McLeod, 1986). Some of the functions the DBMS performs include defining, processing, retrieving, adding, changing, or deleting data within a database (Date, 1990; Kroenke, 1992; Pfaffenberger, 1991).

The DBMS controls the structure of the data, that is, how long it is, whether numbers, characters or both were allowed and in what order. It also determines how the data is stored and retrieved. The physical storage of the data is accomplished through the operating system. The database management system also passes data to applications for processing.

Conclusion: the database management system could impact data sharing.

Operating System. An operating system is software that is used as an interface between the user, the applications, the database management system, and the physical hardware of a computer. The operating system supervises the workload of the computer, controls input and output, manages the computer's memory, places data on storage media, protects the user from errors within the computer or application, provides a way to share data between programs, and controls the sequence of execution for programs (Hipgrave, 1985; Lister, 1984).

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Commercial products exist that can move data between operating systems irrespective of the transfer medium. Degradation of the data is not a problem since the operating system does not process or modify the data.

Conclusion: operating systems would not significantly impact data sharing.

Language. A computer programming language is a code that gives the computer instructions on how to manipulate data. The more sophisticated (or higher) the language, the more closely the code resembles a spoken language. The lowest language, machine code, is a series of Os and 1s (Savitch, 1988).

Computer languages have the ability to initiate other programs that are not necessarily in the same language. Also, application programs for a single database management system are written in various languages without affecting the ability of the DBMS to perform its functions.

Conclusion: computer programming languages would not significantly impact data sharing.

Hardware. Computer hardware is the physical component of the computer. It includes input devices, output devices, one or more processing units, memory, and storage devices. The hardware is incapable of manipulating data by itself. With instructions from a program, the hardware is able to move and process data (Savitch, 1988; Sullivan, Lewis, and Cook, 1985).

The Air Force, through its contracting practices, has forced standardization of computer hardware. Allowing buys only from the standard small computer and standard multi-user small computer contracts has resulted in almost homogeneous computer

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hardware. As older, non-standard machines wear out and are replaced, only standard machines will remain. Large computers fall under similar criteria.

Conclusion: computer hardware would not significantly impact data sharing.

Data. Data are the raw facts and figures that are used for discussion, decision making, calculating, or measuring (McLeod, 1986). Data are contained inside, or outside of an automated system. For the purpose of this paper, data are considered to be residing within an automated system.

The data elements and their corresponding definitions are a prime indicator of the ability to consistently share data. Individual data elements with the same name and different purposes or the same purpose but different formats complicate the ability to share data. On the former, confusion exists as to whether a specific data element is correct to use for accurate transactions. The latter requires some translation or may preclude sharing if the format is too limiting.

Conclusion: data could significantly impact data sharing.

Conclusion. After discussing the eight components of an information system, it is found that, because of their similarities, two can be readily combined to form one. Of the other six, only half could impact data sharing. The final four components that could impact data sharing and will be used to evaluate each logistics information system are: (1) input and output, (2) applications, (3) database management system, and (4) data. Table 2 graphically depicts this summation.

TABLE 2

Information System Components and Data Sharing

	Component	Affect on Data Sharing
1	Input	Impact Combined with 2
2	Output	Impact Combined with 1
3	Applications	Significant Impact if no DBMS
4	Database Management System	Impact
5	Operating System	No Impact
6	Language	No Impact
7	Physical	No Impact
8	Data	Significant Impact

Summary

Chapter III described the case study method, explained why it was chosen for use in this study, and described some limitations of the case study method.. This chapter also discussed what data collection methods were used and how the data were evaluated, Chapter IV describes the the four factors considered significant to data sharing within Chapter III: input and output devices, applications, database management system, and data, in relation to the three logistics information systems. Finally, Chapter V summarizes the previous four chapters, draws conclusions about the interaction of the three logistics information systems under study, and identifies further opportunities for research.

IV. Findings

Organization of the Present Chapter—Overview

Chapter IV describes the the four factors considered significant to data sharing within Chapter III: input and output devices, applications, database management system, and data, in relation to the three logistics information systems.

Findings

Findings for input and output, applications, and database management system are summarized in Table 4, below. Explanations follow the table.

TABLE 3

Comparison of Logistics Information Systems and System Components

Component	CAMS	SBSS	OLVIMS
Input and Output	Sperry 1100/ 2200 Based	Sperry 1100/ 2200 Based	Microprocessor Based
	ICI	ICI	
	1/2 inch Mag Tape	1/2 inch Mag Tape	1/4 inch Mag Tape
		5 1/4 inch Floppy Disk	5 1/4 inch Floppy Disk
	Terminals	Terminals	Terminal
	DDN	DDN	
	Printers	Printers	Printers

TABLE 3, Continued

Component	CAMS	SBSS	OLVIMS
Applications	Front end to DBMS	Front end to DBMS	Direct Data Manipulation
Database Management System	Network	Hierarchical	None

(AFM 66-279, Vol XXVII, 1992; AFM 67-1, Vol II, Part 4, Chapter 5, Section A, 1991; AFM 77-320 Vol I, 1992; Tyson, 1992; Steinhardt, 1992)

Input and Output. The SBSS and CAMS reside on the same Sperry 1100 or 2200 series mainframe computer, depending on what is installed at the particular location. Sharing hardware greatly facilitates their sharing data. The Interactive Communication Interface (ICI), an operating system utility program, aids in transferring data between the SBSS, CAMS and other systems. It allows formatted data to be transferred from one system to another or between different locations. Between two locations, the ICI will format the data for transfer over the Defense Data Network (DDN) using a transmission control procedure/internet protocol. (AFM 66-279, Vol XXVII, 1992; AFM 67-1, Vol II, Part 4, Chapter 5, Section A, 1991; Tyson, 1992; Steinhardt, 1992).

The OLVIMS resides on the standard Air Force Microcomputer. Input and output are somewhat limited because there is no provision for data transfer by way of communications lines, either DDN or telephone. Limited data transfer between OLVIMS and SBSS is carried out by placing data on a 5 1/4 inch magnetic floppy disk and physically carrying it to the other system. Updates and reports that are required by higher headquarters are transferred by means of a magnetic disk through the mail. Other than printing data from one system and then keying the data through a terminal on the other system, there are no common transfer mediums between OLVIMS and CAMS (AFM 77-320 Vol I, 1992; Guchian, 1992; Steinhardt, 1992; Teti, 1992).

Applications. The SBSS and CAMS applications function as a front end to the database management systems for their respective systems. The applications do not deal with the data directly; therefore, the applications neither help nor hinder data sharing.

The OLVIMS is a data storage and retrieval application without a database system. Applications manipulate the data directly instead of going through a file management or data management system. Two-way links between files are identified within the files themselves, but the location of the links within the file is only known by the application. Application dependence makes data sharing difficult, but not impossible. In order to share data with other than OLVIMS applications, an application must be used that knows exactly where the data and its corresponding links are. In addition, access to data within the files is through keys and subkeys. In order to recall specific data, an operator has to know the specific key, usually a vehicle number or a work-order number (Farrell, 1992).

Database Management System. Both the SBSS and the CAMS use a database management system. Application independence allows data to be shared more easily since data can be manipulated without having intimate knowledge of the way the data is physically stored within the system.

The SBSS database uses the Sperry Data Management System—1100 for data base definition. The SBSS database is designed using the CODASYL Worldwide Standards Committee specifications. Access to the database is through a hierarchical relationship. In order to navigate through the database, several levels have to be traversed. First, the area is located, then the record within the area, and, finally, the data element within the record. The database is divided into 38 areas, and 244 records. Records are further grouped into nine types or categories to aid in reports and reports processing. Record

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types are scattered throughout the areas and were not limited to one type in any one area (AFM 67-1, Vol II, Part 4, Chapter 5, Section A, 1991).

The description of the database (including how the data is stored) is contained within the database itself. This coexistence allows greater versatility in data sharing. The description resides in a file called "SBSS*SCHEMAS" that also contains the data dictionary. The database description identifies the location of each data element by coding what record it is stored within. Each record is identified by a unique three-character code which also is the first three characters of the data element label. For instance, the element "National Stock Number" is code "AQN001," meaning it is the first element in the "AQN" record (AFM 67-1, Vol II, Part 4, Chapter 5, Section A, 1991; "Element and Property Definition Information List," 1992).

The CAMS database is managed through a network database structure. Similar to a hierarchical structure, the network structure also requires passing through several layers to arrive at the data element. Access to the data element is through a database key. The key is composed of the area name, page number, and record number that the data element resides in (AFM 66-279, Vol I, 1990).

The description of the CAMS database is included in files integral to the database, again, making data sharing easier. The overall description is contained in a file called "SCH/DOC-5R1" with paths between levels described within files called "QLP/DOC-5R1" for single-level navigation and "CV/DOC-5R1" for selected multi-level navigation (AFM 66-279, Vol XIX, 1992).

The OLVIMS was built without using a database management system. Absence of a database management system makes data sharing very difficult for reasons explained in the applications section. In order to allow ad hoc inquiries of the system, a conversion

application was designed to translate the OLVIMS files into CONDOR III formatted database management files. Using Condor III allows inquiries other than standard reports to be made utilizing the CONDOR III database management system (Farrell, 1992; AFM 77-320, Vol 1, 1992)

Data. Fifty data elements from the three logistics information systems were compared. Elements were chosen as those most likely to either be shared among the three systems or required for management reports and review. These elements were confirmed by the thesis advisors. The list of data elements, along with the systems in which they reside and their structure, is contained in Table 4.

TABLE 4

Data Elements Within Logistics Information Systems

	Data Element	SBSS	CAMS	OLVIMS
1	ACTION DATE	5 N	5 N (YYDDD)	5 N (YYDDD)
2	ACTION TIME	4 X	4 N (HHMM)	4 N (HHMM)
3	APPOINTMENT DATE			6 X (YY/MM/DD)
4	COST	10 X		7 N (99)
5	DATE	6 N (YYMMDD)		
6	DATE	5 N		5 N (YYDDD)
7	DATE	4 X		
8	DATE OPENED			5 N (YYDDD)
9	DOCUMENT NUMBER	8 X		
10	DOCUMENT NUMBER	14 X	14 X	14 X
11	DOCUMENT NUMBER	16 X		
12	DOLLAR VALUE	8 N (99)		
13	ELEMENT OF EXPENSE INVESTMENT CODE	3 X		3 X
14	ELEMENT OF EXPENSE INVESTMENT CODE	5 X		

	Data Element	SBSS	CAMS	OLVIMS
15	EMPLOYEE NUMBER		5 N	5 N
16	EQUIP ID/SERIAL NUMBER		7 X	
17	EXTENDED COST	10 N		
18	EXTENDED COST	8 X		
19	EXTENDED COST, SIGNED	10 SN		
20	EXTENDED PRICE	8 SN (99)		
	Data Element	SBSS	CAMS	OLVIMS
21	NATIONAL STOCK NUMBER	18 X		12 X
22	NSN/PN/QRL NR	15 X	15 X	12 X
23	NOMENCLATURE	19 X	15 X	15 X
24	ORGANIZATION CODE	3 N		
25	ORGANIZATION CODE	3 X		2 X
26	ORGANIZATION IDENTIFICATION CODE	12 X		
27	ORGANIZATION/SHOP CODE		5 X	
28	QUANTITY	6 X		
29	QUANTITY	10 N		
30	QUANTITY	7 SN		
31	QUANTITY	6 N		
32	QUANTITY	4 N		3 N
33	QUANTITY	5 N	5 N	
34	QUANTITY	2 N		
35	QUANTITY	7 SN		
36	QUANTITY	1 N		
37	QUANTITY	8 N		
38	QUANTITY	5 SN		
39	QUANTITY ORDERED/ DUE IN	5 N	5 N	
40	RESPONSIBILITY/COST CENTER CODE	6 X		6 X
41	STOCK NUMBER		15 X	
42	TIME OPENED			4 N (HHMM)

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TABLE 4, Continued

	Data Element	SBSS	CAMS	OLVIMS
43	TOTAL COST			6 N (99)
44	TOTAL COST			7 N
45	UNIT OF ISSUE	2 X	2 X	
46	UNIT-ID		1 A	2 X
47	URGENCY JUSTIFICATION CODE	2 X	2 X	
48	USER IDENTIFICATION	6 X		
49	VEHICLE REGISTRATION NUMBER	8 X		6 X

KEY: The initial numeral indicates the number of characters available to the data element. The second group of characters indicates the type of characters allowed in the data element. The group in parenthesis indicates a specific format that is required for that data element.

	Data Type		Format
X	Any Character	Y	Year
A	Alphabetic Character	M	Month
N	Numeric Character	D	Day
SN	Signed Numeric (+ or -)	H	Hour
		M	Minute
		9	Decimal Place, 1 for each

(AFM 66-279, Vol XXVII, 1992; AFM 77-320, Vol 1, 1992; "Element and Property Definition Information List," 1992)

Data Dictionary. The SBSS was the only system studied that has a computerized data dictionary. It lists the data code which identifies the record the data resides in, the name of the data element, and the input, interrogation, and output formats of the data. It does have shortcomings, however. The data dictionary does not have a narrative description of the data elements even though several have identical or similar names but different structures. For instance, Table 5, data elements 5 through 7 are all DATE, one with six numerals, one with five numerals, and the last with four characters of any kind. There are ten QUANTITYs with as many different structures. The lack of

exhaustive definitions will cause problems in identifying appropriate data elements and could lead to incorrect or nonsensical results.

The CAMS contains 20 subsystems within its overall umbrella. Each of the 20 subsystems is accompanied by its own manual which contains the data dictionary for that subsystem. Data elements compared in this study are from the Maintenance-Supply Interface Subsystem which is described in AFM 66-279, Vol XXVII, 1 March 1992.

The CAMS data dictionary provides sufficient detail to identify the function as well as the structure of each data element. The data dictionary is arranged by input and output format screens with data descriptions arranged in the order in which they appear on the screen. There is no comprehensive dictionary that lists data elements in alphabetical order nor is there any indication of how or where the data is stored. This arrangement of data elements makes identifying eligible elements for data sharing very difficult. It also could lead to errors caused by falsely identifying data. Data stored in one element could easily be mistaken for multiple elements or different data elements for references of a single element. This is the result of the confusion caused by element names which are listed in multiple screens but no storage location is given.

OLVIMS data definitions listed in AFM 77-320 Vol 1, 1 May 1992, are the most comprehensive of the three systems studied. However, like the CAMS, the data elements are grouped by screens and listed in the order of their appearance. Also, the lengths of the data elements are not explicitly stated. Lengths were determined in this study by either reviewing the format within the definition of the element or by counting the spaces shown on the screen rendition in the manual, a very risky arrangement. Errors in data element length could make data sharing difficult. For instance, in Table 5, data element 22, OLVIMS allows 12 characters, while SBSS allows 18. SBSS sharing

OLVIMS' NATIONAL STOCK NUMBER would not be a problem because SBSS NATIONAL STOCK NUMBER is larger than OLVIMS NATIONAL STOCK NUMBER. OLVIMS sharing SBSS NATIONAL STOCK NUMBER would require some method of shortening the data element in order that it would fit into OLVIMS' allocated space.

Data Element. Data is most easily shared when the format for the data element is identical. For instance, Table 5, data element 15, EMPLOYEE NUMBER, is identically formatted for CAMS and OLVIMS. An identical format allows an employee number to be used by either system without adverse effects. Identical data elements occur in Table 5, Elements 1, 10, 33, 39, 40, and 46.

For data elements that are not identically formatted, the data must be converted to a common format before sharing. This action can become quite involved and may require user intervention. For instance, Data Element 4, COST, when sharing from SBSS to OLVIMS, requires that multiple manual transactions be made to account for items that cost $10,000.00 or more. Other, less critical data are truncated automatically, such as data element 23, NOMENCLATURE, or zeros in specific places are removed, such as data element 50, VEHICLE REGISTRATION NUMBER, so that the data will fit into the data element (AFM 77-320, Vol I).

Summary

Chapter IV described the the four factors considered significant to data sharing within Chapter III: input and output devices, applications, database management system, and data, in relation to the three logistics information systems. Chapter V will provide a summation of Chapters I through III, provide conclusions drawn from the results reported in Chapter IV, and list recommendations to enhance data sharing between the logistics information systems. Finally, topics for further study will be considered.

V. Summary, Conclusions, and Recommendations

Organization of the Present Chapter—Overview

This chapter provides a summation of Chapters I through III, draws conclusions from the results reported in Chapter IV, and list recommendations to enhance data sharing between the logistics information systems. Finally, topics for further study will be considered.

Summary

The Air Force has changed. With this change has come a shift in management responsibilities within the logistics community. Formerly diverse functions have come under the purview of a single manager—the Logistics Group Commander. This single manager has inherited information systems that may or may not be able to provide consolidated information in order to make informed and accurate decisions. The purpose of this thesis was to describe the current and potential ability for three logistics information management systems to share data.

A literature review conducted within the scope of this thesis has discovered two theories on how data sharing might be possible. The first was to design or redesign all information systems to share data. The second was to design an open system interface that would use artificial intelligence to translate data and inquiries between database management systems. All of the authors admitted that no fully shared data systems have been implemented as of this writing.

This thesis used the case study methodology to produce its results. Data collection was through documentation research with secondary emphasis placed on personal interviews using open ended questions. The components of the logistics information

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systems that were evaluated for inclusion in the study were input, output, applications, database management system, operating system, programming language, computer hardware, and data. The four areas that could have impacted data sharing and were included in a more thorough investigation were the input and output (treated as a single component), applications, database management system, and data.

Conclusions

Input and Output. All systems had adequate input and output methods to share data with other systems. The input and output for the OLVIMS, however, was inadequate for increasing the frequency of sharing data above that which was used at the time of this study. Limiting input to the terminal's keyboard or to a magnetic disk may require an inordinate amount of time and effort to be expended by an operator in relationship to the amount and significance of the data that is entered into the system. SBSS and CAMS have the greatest potential for sharing data because both systems share hardware. CAMS and OLVIMS have the least potential for sharing data because there are no high-speed common input and output methods between the two.

Applications. The SBSS and CAMS applications were neither a hindrance nor a help to sharing data between systems. Because the applications acted as front ends to database management systems, the applications did not directly affect the data. Within OLVIMS the applications did directly affect the data. The structure of the data was contained within the application itself; therefore, any attempt to share the data would require intimate knowledge of the application in order to share the data with another system. SBSS and CAMS have the greatest potential for sharing data because of the absence of application specific data. OLVIMS has the least potential for sharing data because of its application specific data requirement.

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Database Management System. The use of a database management system within the SBSS and the CAMS significantly enhanced the ability to share data contained within the systems. The data structure and relationships were readily available without having intimate knowledge of the application. Inquiries, modifications, additions, and deletions could be made utilizing the utilities within the database management system. SBSS and CAMS have the greatest potential for sharing data because of their use of standardized database management systems. OLVIMS has the least potential for sharing data because of its lack of a standardized database management system.

Data. The largest obstacle for sharing data in all three systems was the data itself. All three systems had shortfalls in the documentation describing the data elements. The SBSS data dictionary was the easiest to use, but did not contain data descriptions to differentiate elements with identical or similar names. The OLVIMS data dictionary had the best descriptions of the data, but was ungainly to use and did not definitively identify the lengths of the elements.

The shortfalls within each data dictionary made identification of all identical data elements impossible. Even though the SBSS and CAMS and the SBSS and OLVIMS regularly interact, the documentation was not comprehensive enough to identify which data elements were being used between the systems. The inadequacies of the data dictionaries would preclude any universal data sharing between the three systems studied and any other systems.

Recommendations

Any information management system can be improved, but the purpose of this section is not to find fault but to recommend areas that need attention in order to facilitate data sharing. Some data sharing has occurred, but the potential exists that much

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more could occur with some modifications to the existing logistics management systems. The recommendations are listed in decreasing order of significance.

Emphasis should be placed on completing the data dictionaries within each logistics information system. Only then can any real progress be made on sharing data between systems. Without a comprehensive, logically ordered data dictionary available for systems developers, any attempt at sharing data among new or existing systems would be very difficult or futile.

The input and output capability of OLVIMS should be enhanced. The limitation of methods to communicate with other systems precludes data sharing.

OLVIMS should be redesigned around a database management system. With an application independent database, data sharing as well as ad hoc inquiries would be significantly simplified.

Further Study

This thesis is only a scratch on the surface of a very large mountain. The 19 other modules of CAMS as well as all the other logistics management systems within the Air Force deserve similar analysis. Also, when adequate data dictionaries become available for the three logistics support systems studied within this thesis, data elements could be scrutinized to determine if the systems could be streamlined while data elements can be eliminated, consolidated, or otherwise modified, further simplifying already complex logistics information systems.

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Appendix: Acronyms

CAMS: Consolidated Aircraft Management System

COBOL: COmmon Business Oriented Language

CODASYL: Committee On DAta SYstems Languages

DBMS: Database Management System

DDN: Defense Data Network

ICI: Interactive Communication Interface

OLVIMS: On-Line Vehicle Interactive Management System

SBSS: Standard Base Supply System

TCP/IP: Transmission Control Procedure/Internet Protocol

VIMS: Vehicle Integrated Management System

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<u>Vita</u>

James E. Hogue was born on 25 December, 1956 in Albany California. He attended Wayland Baptist University, Plainview, Texas, receiving the degree of Bachelor of Music with a major in Education in May 1979. He was commissioned in the Air Force through Officer's Training School in February, 1980. He has held several positions in the Air Force, including: Executive Officer at the squadron and wing level, Squadron Section Commander, Assistant Operations Support Branch Chief, and Assistant Chief, Central Base Administration. He has served at Scott Air Force Base, Illinois; Lackland Air Force Base, Texas; Royal Air Force Woodbridge, United Kingdom; and Pope Air Force Base, North Carolina. Mister Hogue was selected to attend the Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio, in the School of Logistics and Acquisition and attended as a student from May 1991 until his separation. He was separated from the Air Force as a captain under the voluntary separation program in August 1992.

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A change within the Air Force has shifted management responsibilities within the logistics community. Formerly diverse functions have come under the purview of a single manager—the Logistics Group Commander—who has inherited information systems that may not be able to provide consolidated information for informed and accurate decision making. The purpose of this thesis was to describe the current and potential ability for three logistics information management systems to share data: Standard Base Supply System, Consolidated Aircraft Management System, and On-Line Vehicle Information Management System. A systems model was synthesized from the literature review to determine what components of a system may impact data sharing. Identified were input and output, applications without a database management system, absence of a database management system, and the data itself. Data was gathered through the study of each system's documentation along with interviews from systems managers and experts. It was found that documentation for system data was inadequate and was the largest obstacle to data sharing. Recommendations included revising documentation, providing more input and output capability for the On-Line Vehicle Information Management System, and redesigning the On-Line Vehicle Information Management System to operate around a database management system.

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